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STATUS OF FIVE BUTTERFLIES AND SKIPPERS IN BRITISH COLUMBIA

by
Jon H. Shepard

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In 1992, the Provincial Government initiated a co-operative biodiversity research program with funding from the Corporate Resource Inventory Initiative, the British Columbia Ministries of Forests (Research Branch), Environment, Lands, and Parks (Wildlife and Habitat Protection Branches), and Tourism and Culture (Royal B.C. Museum), and the Forest Resource Development Agreement (FRDA II).

In 1995, the Ministry of Forests Research Branch and the Ministry of Environment, Lands and Parks developed a biodiversity research and extension strategy, with the assistance of the provincial research community. This strategy was presented to Forest Renewal BC (FRBC), who provided funding for a program beginning in 1995. The goal of the extension component of this program is to extend information to scientists, resource managers, and the public through biodiversity publications. These publications are intended to increase awareness and understanding of biodiversity, promote the concepts and importance of conserving biodiversity, and communicate provincial government initiatives related to biodiversity. We hope that they will be used as tools for the conservation of British Columbia's rich, living legacy.

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Jon H. Shepard

BRITISH COLUMBIA

Ministry of Environment, Lands and Parks
Wildlife Branch
and
Resources Inventory Branch
Victoria, BC

Wildlife Working Report No. WR-101

March 2000

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FOREWORD

The views expressed herein are those of the author and do not necessarily represent those of the B.C. Ministry of Environment, Lands and Parks.

In cases where a Wildlife Working Report or Bulletin is also a species' status report, it may contain a status recommended for the species by the author. This recommended status designation is the opinion of the author and may not necessarily reflect that of the Wildlife Branch. Official status designation will be made by the Wildlife Branch in consultation with experts, and the data contained in the status report will be considered during the evaluation process.

SUMMARY

In British Columbia, the Dun Skipper, *Euphyes vestris* (Boisduval), is known from southeast Vancouver Island, along the Fraser River from Hope to Lillooet, and three isolated localities: Powell River, Pemberton, and Mission. The Dun Skipper has never been common in British Columbia, and even before anthropogenic changes to its habitat, it was vulnerable in the province. It is also vulnerable along the west coast of the United States where it occurs in Washington, Oregon, and California. The only subspecies in the province is the nominate *E. vestris vestris*; its Conservation Data Centre (Association of Biodiversity Information) rank is recommended to be G5T3 N2 S2. The species should therefore be placed on the provincial Red List in British Columbia.

The Island Marble, an undescribed subspecies of *Euchloe ausonides* (Lucas), was historically found on Gabriola Island and at lower elevations on eastern Vancouver Island from Nanaimo south to Victoria, but it has not been recorded in Canada since 1908. In 1998, however, butterflies of this subspecies were recorded for the first time on San Juan Island, Washington State, a short distance across Haro Strait from Victoria. Nothing has ever been recorded about this subspecies' larval foodplants. Elsewhere, the larvae of other subspecies of *Euchloe ausonides* feed primarily on rockcresses in the genus *Arabis*, a genus that occurs on Vancouver Island as well, where it is also a larval food source for the related species, Sara's Orangetip, *Anthocharis sara* Lucas. The Pacific Orangetip has a much wider altitudinal range on Vancouver Island than the Island Marble and is still found on steep hillsides. Because this butterfly disappeared from British Columbia before 1910, it is unlikely that the spread of introduced weed species and post World War I growth of the human population were factors in its extirpation. The most likely cause for its loss is the elimination of its larval foodplant in its low-lying, flat habitat by the intensive grazing of sheep and/or cattle. It is recommended that this undescribed subspecies of *Euchloe ausonides* be designated as Extirpated in British Columbia, and thus placed on the provincial Red List.

The Behr's Hairstreak, *Satyrium behrii* (W.H. Edwards), occurs in Canada from the Penticton area south to Osoyoos. Although it still occurs in scattered populations throughout its historic range, the only known strong population occurs on the east side of Osoyoos Lake in the Osoyoos Indian Reserve, a site that has been recently reduced in size by vineyard expansion and further threatened by other planned developments. Except for two small Ecological Reserves, a small area of the South Okanagan Wildlife Management Area, and a small area included in the Vaseux Bighorn National Wildlife Area, the British Columbia occurrences of the Behr's Hairstreak are not protected by provincial or federal Ecological Reserves or parks. The known larval host plant is antelope-brush, *Purshia tridentata* (Pursh) DC. In the United States there are several other insects that are known to feed only on antelope-brush. Most of these also occur in British Columbia and are as limited in their distribution in Canada as the Behr's Hairstreak.

The Island Blue, *Plebejus saepiolus insulanus* Blackmore, a subspecies of the Greenish Blue, *Plebejus saepiolus* (Boisduval), occurred on Vancouver Island from Saratoga Beach near Campbell River south to Victoria. It has not been seen since 1979 and may be extinct. In the absence of an intensive survey for this subspecies, it should be considered historical and placed on the provincial Red List with a Conservation Data Centre rank of GH SH. Outside B.C., the larvae of other subspecies of *Plebejus saepiolus* feed on clover (*Trifolium* sp.). Urbanization, invasive introduced plants and/or control of forest fires may have greatly reduced the larval hostplant for the Island Blue.

In British Columbia, the Taylor's Checkerspot, *Euphydryas editha taylori* (W.H. Edwards), was historically known to occur on Hornby Island, near Mill Bay, at Bright Angel Provincial Park, and at various sites in and around Victoria. It is now found only on Hornby Island. In the United States it was found in the Willamette Valley of Oregon and in Washington near Tenino, at Fort Lewis, on various San Juan Islands, and at Dungeness National Wildlife Refuge near Sequim. Most of the Oregon and Washington populations are now extirpated or greatly reduced in size. Much of the habitat of the Taylor's Checkerspot (Garry oak meadows) has been alienated by urbanization and farming. It appears that introduced grasses and scotch broom (*Cytisus scoparius*) have eliminated the adult nectar sources and larval foodplants in most remaining habitats. *Euphydryas editha taylori* should be considered globally endangered, and should remain on the British Columbia Red List with a rank of G5T1 S1.

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1 INTRODUCTION

The conservation status of butterflies in British Columbia was first considered on a provincial scale by Guppy et al. (1994). Since then, several formal surveys have been undertaken that focused on rare and rarely collected species, particularly on southeastern Vancouver Island (Shepard 1996), the Okanagan Valley (St. John 1996), and in the Peace River area (Shepard 2000). As a result, an updated list of species at risk — a provincial Red and Blue List — has been developed by C. Guppy and S. Cannings (Appendix 1). There are at present eighteen taxa of butterflies on the Red List; the five treated in some detail in this report were chosen from that list in order to begin the process of reporting on the status of the Lepidoptera of the province.

2 DUN SKIPPER

Euphyes vestris (Boisduval)
Skippers: Family Hesperiidae

2.1 Taxonomic Status

Several recent books give the species name as *Euphyes ruricola* (Boisduval). However, this name cannot be assigned to any known taxon and is a *nomen dubia* (MacNeil 1964; Brown and McGuire 1983). The correct name for the species is *Euphyes vestris* (Boisduval). Emmel et al. (1998) restrict the type locality to Spanish Ranch Road at Meadow Valley, 3600' (1100m), Plumas County, California, and recognize three subspecies, of which the nominate subspecies, *Euphyes vestris vestris*, is found from the central Sierra foothills north through the Klamath Mountains to the Oregon border. Hinchliff (1994, 1996) regarded populations of this species from the eastern foothills of the Cascades westward in Oregon and Washington also to be the nominate subspecies. Known British Columbia populations of the Dun Skipper should also be classified as the nominate subspecies. Guppy et al. (1994) and Layberry et al. (1998) were in error in saying that BC populations belong to the eastern subspecies, *E. v. metacomet* (Harris), whose type locality is "Massachusetts." If one recognizes that this species consists of subspecies, such lumping of all Canadian populations under *E. v. metacomet* is unjustifiable and contrary to recent taxonomic publications (Brown and McGuire 1983).

2.2 Biology

The Dun Skipper is single-brooded at the northern limits of its range and double-brooded at the southern limits of its range (Opler and Krizek 1984). In British Columbia, *E. v. vestris* is single-brooded, with recorded flight dates from 6 June to 5 Aug. All late records are females with one exception, a single male collected on 17 August 1932. The presence of this male indicates that there may rarely be a partial second brood. Nothing further is known of the biology of the Dun Skipper in British Columbia.

In eastern North America, Heitzman (1964) records the sedge (*Cyperus esculentus* L.) as a larval hostplant for the Dun Skipper, and Layberry et al. (1998) record various *Carex* species as larval hostplants. The overwintering stage is unknown, but considering the time of adult flight, the butterfly must overwinter as a late instar larva.

2.3 Habitat

On Vancouver Island the butterfly is found in open, moist but not marshy or boggy areas where the larval foodplant occurs. These can be disturbed areas, such as railroad right-of-ways, powerline right-of-ways, or roadside ditches. The Fraser River Canyon populations of the butterfly are in xeric conditions where permanent springs or spring floods maintain the larval foodplant.

2.4 Distribution

In British Columbia, the Dun Skipper occurs on Vancouver Island from Courtenay south to Thetis Lake Park, but is absent from the Saanich Peninsula. It is also known from one locality north of Vancouver on the coast at Powell River, one locality near Pemberton, Mission, and five localities in the Fraser River Canyon: Hope, Boston Bar, Lytton, North Lytton, and Lillooet (Figure 1, Appendix 2). Elsewhere in North America, this species is widely distributed throughout the east, but has scattered, disjunct populations in the west. The subspecies in British Columbia, *E. vestris vestris*, ranges southward in the Cascade, Sierra Nevada and Coast Mountains to central California.

2.5 Protection and Status

Some historic populations of the Dun Skipper occurred within the boundaries of current provincial parks; however, none have been seen within park

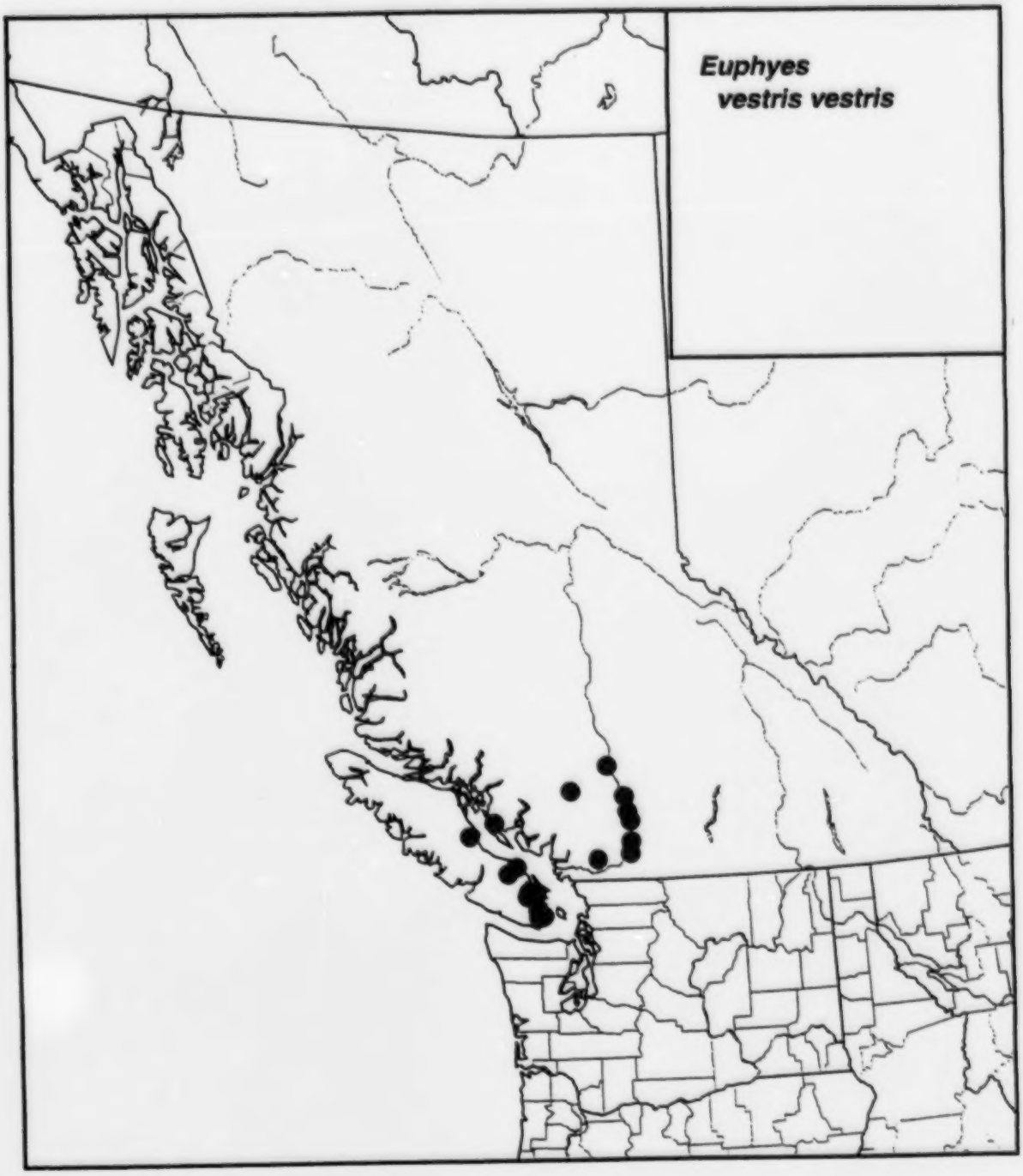

Figure 1. Distribution of *Euphyes vestris vestris* in British Columbia.

boundaries in the last three decades. In 1995, the species was not seen during an extensive survey of the Vancouver Island portion of its range (Shepard 1996). Except for one record on the Nanaimo Lakes Road in 1988 (a site subsequently eliminated), the Dun Skipper has not been collected on Vancouver Island since 1963. There were, however, five sightings of individual Dun Skippers by reliable observers from 1994 through 1996 (BC Conservation Data Centre, S. Cannings, pers. comm.). On the mainland, there have been only five records since 1980. On both Vancouver Island and on the mainland in the Fraser Canyon and North Pemberton, it has been seen only as one to three individuals at a time, even in early historic records. Thus, it appears never to have been common. In the Fraser Canyon, it is associated with small, moist areas at permanent springs, a very vulnerable habitat. It has also been taken in moist areas at the top edge of the flood waters along the Fraser River near Lytton. In the rest of the subspecies' range in the western United States of Washington, Oregon, and California, it is uncommon to rare. In Washington, it is ranked S1. Thus, the author recommends that the subspecies' status be revised to G5T3 N2 S2, a rank that indicates that it is vulnerable globally and places it on the provincial Red List of candidates for Threatened status.

2.6 Population Size and Trend

All records for the last decade and all historic museum records for British Columbia and Washington indicate that only one to three individuals are seen at a time. At best, repeated observations at one site will yield a few individual adults in any one adult flight period. The only exception to this is the very dry area south of Ellensburg, Washington, where extensive seeps maintain large concentrations of the larval foodplant even in roadside ditches. Further to the south in Oregon there are stronger populations, but it is not a common species even in its California range. Because the contemporary and historic records in British Columbia essentially are sightings of only single individuals, it is not possible to estimate the population size or trend of any single population. As the annual number of sightings on Vancouver Island has declined over the last hundred years, it is assumed that the species is no longer as common on Vancouver Island as it once was. The single individual seen on Vancouver Island in 1988 was in habitat subsequently overrun by scotch broom, *Cytisus scoparius*, by 1999 (C.S. Guppy, per. comm.).

2.7 Limiting Factors

This species requires specific larval foodplants which are any of a variety of sedges of the genus *Carex* (Layberry et al. 1998) and *Cyperus esculentus* (Heitzman 1964). None of the species of *Carex* documented as being used by this species elsewhere are found in British Columbia, but many other *Carex* species occur in the province. *Cyperus esculentus* and other *Cyperus* species also are found in British Columbia. On Vancouver Island, there are several potential foodplant species in the genus *Carex*. The distribution of the Dun Skipper may be limited because it will use only one or two of the available *Carex* or *Cyperus* species in any given habitat. This phenomenon of hostplant specificity at any one locality but host polyphagy over the entire range is known to occur with other butterfly species.

2.8 Special Significance of the Species

The decline of the Dun Skipper focuses attention on the reduction and degradation of its habitat. It has similar habitat requirements to those of the Island Blue, *Plebejus saepiolus insulanus*, another rare butterfly. On Vancouver Island, this restricted habitat has been greatly reduced by human manipulation, especially drainage, and by invasion of weedy, exotic plants, especially scotch broom.

2.9 Recommendations

A search for populations of the Dun Skipper on Vancouver Island should be conducted along road, railroad, and powerline right-of-ways throughout the Malahat region and north at least to Duncan. If viable populations of the butterfly are found, the larval hostplant should be determined. If the species can be located and the foodplant determined, appropriate management and habitat protection can be implemented. The Dun Skipper's conservation rank in British Columbia should be S2 and the species should be Red-listed.

3 ISLAND MARBLE

Euchloe ausonides, undescribed subspecies
Whites and Sulphurs: Family Pieridae

3.1 Taxonomic Status

Layberry et. al (1998) recognize three subspecies of the Large Marble. The boreal subspecies, *Euchloe ausonides mayi* F. and R. Chermock, occupies most of the range of the species in Canada. *E. a. ogilvia* Back is found in northwestern British Columbia, Yukon Territory and adjacent Alaska. The undescribed Island Marble is known to have existed only on Vancouver, Gabriola, and San Juan Islands and is known to persist only on the latter. The nominate subspecies is restricted to California (Emmel 1998).

3.2 Biology

Little is published on the biology of the species as a whole. Tietz (1972) and Bridges (1988) list eight references published prior to 1927, all with brief descriptions of the larva and recording rockcresses (*Arabis* spp.) as larval foodplants. Opler (1975) described the larva of *E. ausonides* and summarized its known foodplants. He documented that the Large Marble can utilize introduced weedy crucifers (Brassicaceae) (e.g., *Brassica* spp.) as well as native rockcresses (*Arabis* spp.). *Arabis* species are also a larval food source for the related species, Sara's Orangetip, *Anthocharis sara* Lucas. Sara's Orangetip has a much wider altitudinal range on Vancouver Island than the Island Marble and is still found on steep hillsides. Shields et al. (1970) record *Arabis* sp. and *Descurainia californica* (Gray) as foodplants for *E. ausonides*. Shapiro (1977) records *Lepidium densiflorum* Schrad., an annual weedy crucifer, as a foodplant for *E. a. ogilvia*.

3.3 Habitat

There are no published accounts of the habitat of the Island Marble. However, from locality labels on museum specimens it can only be assumed that it inhabited open grassland in Garry oak woodland and lower south-facing slopes with open habitat. In British Columbia, Garry oak ecosystems are restricted to southeast Vancouver Island and a few small, isolated areas in the lower Fraser River Valley of the adjacent Lower Mainland. On the mainland they does not have the same understory plants as on Vancouver Island. The San Juan Island, Washington population occurs in similar habitat.

3.4 Distribution

The former known range of the Island Marble in British Columbia was four sites distributed among the Greater Victoria area, Nanaimo (recorded as Wellington), and on Gabriola Island (Figure 2). The earliest record, from the 1860's, was a specimen labelled simply "Vancouver" this was most likely a reference to Vancouver Island.

This subspecies is isolated from the rest of the species' range. The species apparently never occurred in the Puget Trough of Washington State or the Willamette Valley of Oregon. However, in the summer of 1998 a small population was located at San Juan Island Historical Park, American Camp, San Juan Island, Washington (J. Fleckenstein, per. comm.). In British Columbia, Washington and northwest Oregon, there are no other records of the species west of the Cascade Mountains (Hinchliff 1994, 1996; Layberry et al. 1998) (Appendix 3). However, there remains the remote possibility that the Island Marble may occur on Sidney, James or D'Arcy Islands, three small islands that are located between Vancouver Island and San Juan Island.

The nominate subspecies occurs in all drier habitats in British Columbia, Washington and northwest Oregon east of the Coast Range and Cascade Mountains.

The species as a whole is found from Alaska south to California and Colorado and east to Ontario and Minnesota.

3.5 Protection and Status

This undescribed subspecies of Large Marble is extirpated from British Columbia and Canada. It was not recognized as endangered prior to its extirpation. Currently there are no laws in British Columbia that can be applied to directly protect endangered or threatened species of butterflies. Potential breeding habitat could be protected under the *Ecological Reserves Act* or the *Park Act*. Present Conservation Data Centre ranking for the Island Marble is G5T1Q NX SX, indicating that although the Large Marble as a species is considered to be secure, the Island Marble subspecies is Globally imperiled, and extirpated from Canada and British Columbia.

3.6 Population Size and Trend

For British Columbia, only fourteen specimens of the Island Marble are known to exist in museum collections. All date from the 1860s to 1908, and all

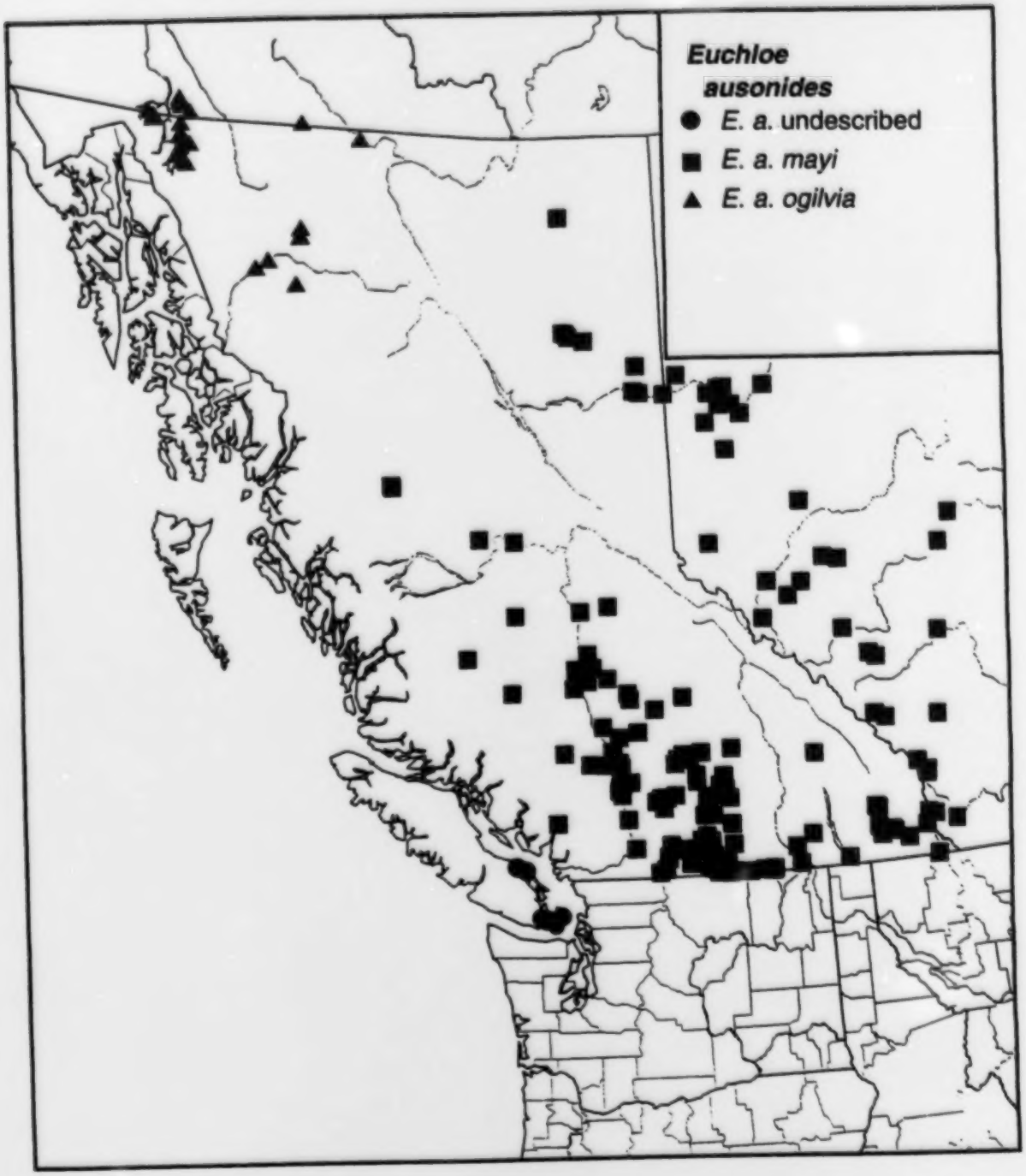

Figure 2. Distribution of *Euchloe ausonides* in British Columbia (and adjacent jurisdictions).

represent captures of single specimens. The only indication that more than one specimen was ever collected at a time is the specimen housed in the Smithsonian Institution that was collected by J. Fletcher, a Canadian entomologist employed by the federal government. It seems unlikely that Fletcher would have given a unique specimen to the Smithsonian unless more specimens had been collected. However, if they were, any retained duplicates have been lost. Since southern Vancouver Island is one of the best documented areas for butterflies in Canada, it seems that this subspecies was never very common there. It is now considered extirpated from Canada.

3.7 Limiting Factors

Elsewhere in North America, *Euchloe ausonides* requires specific larval foodplants in the Brassicaceae family, especially rockcresses in the genus *Arabis*. On Vancouver Island, *Arabis* species are associated with beaches, cliffs, open areas and disturbed sites. *Arabis hirsuta* (L.) Scop., which occurs on the island and south through the Puget Trough and Willamette Valley, is the presumed larval foodplant of the Island Marble. Other crucifers on which *Euchloe ausonides* larvae have been reared in North America are represented on Vancouver Island only by various introduced, weedy species, none of which could have been the original larval foodplant. It is not known if these introduced larval host plants were present prior to the extirpation of the Island Marble.

3.8 Special Significance of the Subspecies

All the larval requirements of the Island Marble are met by Garry oak meadows. These areas form one of Canada's most endangered ecosystems, and are home to many other species that are provincially or nationally at risk. The disappearance of the Island Marble highlights once more the plight of this ecosystem.

3.9 Recommendations

If the San Juan Island, Washington population, when examined more critically, proves to be of sufficient size, it could be used to re-establish the Island Marble in British Columbia. Since we now have a better idea of the habitat needs of this butterfly from the one Washington population, three of the islands between Vancouver Island and San Juan Island (namely Sidney Island, James Island and D'Arcy Island), should be surveyed on the chance that the Island Marble still exists in Canada. These islands should also be examined to find the best habitat for possible future re-introduction.

4 BEHR'S HAIRSTREAK

Satyrium behrii (W.H. Edwards)
Coppers, Hairstreaks, and Blues: Family Lycaenidae

4.1 Taxonomic Status

The British Columbia populations are included within *S. b. columbia* McDunnough. Washington and Oregon workers have treated their populations as the same subspecies (Guppy and Shepard, in press).

4.2 Biology

Comstock (1928) described the mature larva and recorded the larval hostplant. In California this species overwinters as an egg (Emmel and Emmel 1973). Nothing has been published on the biology of the Behr's Hairstreak in British Columbia, Washington, or Oregon. However, an individual was reared from a caterpillar collected on antelope-brush, *Purshia tridentata*, at Vaseux Lake (C.S. Guppy, pers. comm.), and the species is always found flying in association with *Purshia tridentata*. Behr's Hairstreak has one generation per year in British Columbia. Adults are found flying from late May to late July, depending on early spring weather. In normal years the peak flight is in early July (Guppy and Shepard, in press). Nothing is known about the details of the life history, including potential parasites or predators, and no mark-release-recapture studies have been conducted to determine even the rudiments of population structure.

4.3 Habitat

Behr's Hairstreak occupies dry riparian and steep hillside habitat at low elevations where the larval foodplant, antelope-brush, occurs (St. John 1996; Guppy and Shepard in press). This ecosystem is restricted in British Columbia to the southern Okanagan valley floor and the first level of benches above the valley floor. It is one of the most restricted and endangered ecosystems in Canada (Schluter et al. 1995).

4.4 Distribution

In British Columbia (and Canada), the Behr's Hairstreak is restricted to the southern Okanagan Valley from Penticton south to the U.S. border (Jones

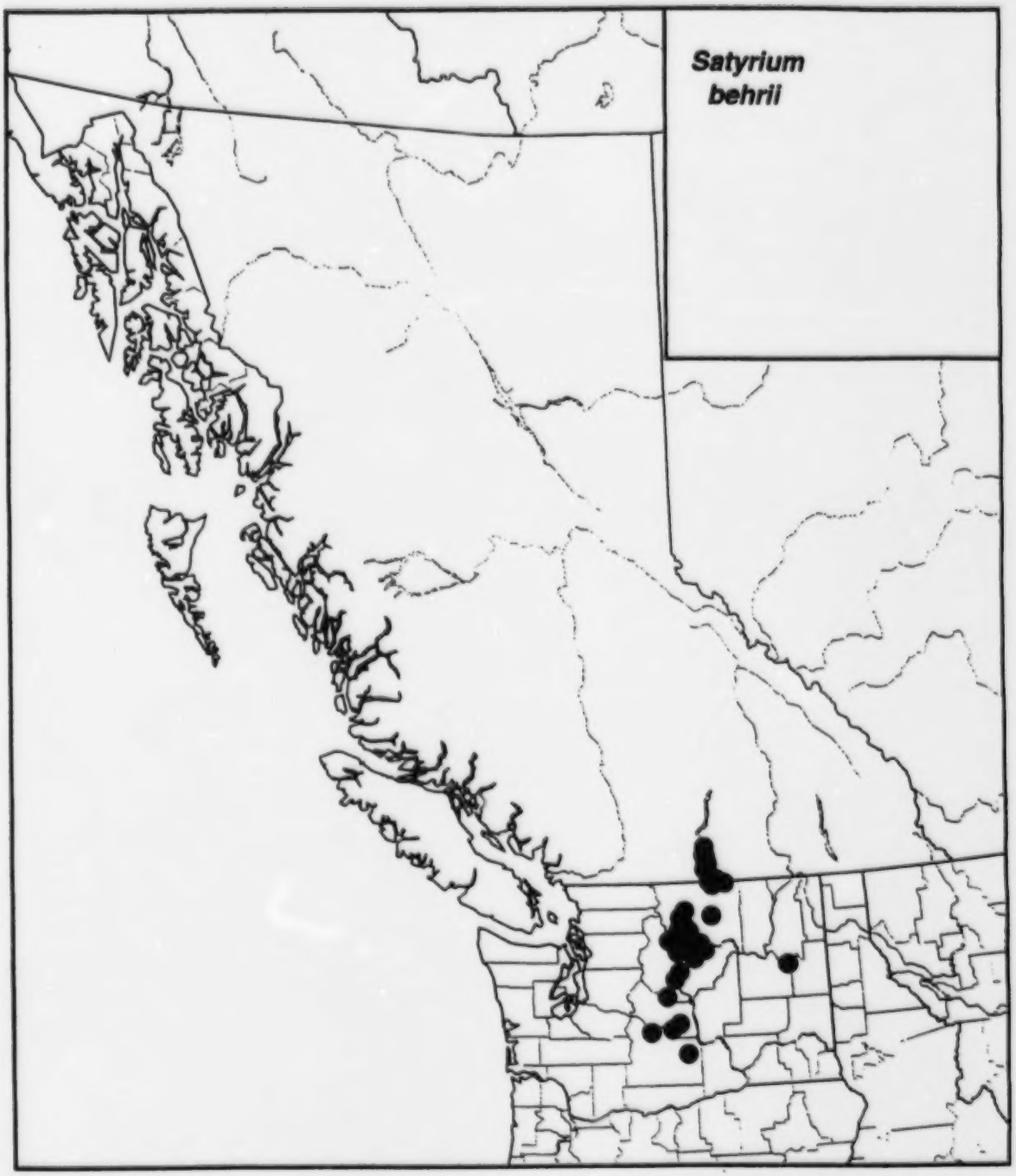

Figure 3. Distribution of *Satyrium behrii* in British Columbia and adjacent Washington (USA).

1951) (Figure 3, Appendix 4). There is a single museum specimen of the species for the North Okanagan in the American Museum of Natural History, but the specimen is believed to be mislabelled. The larval foodplant is not known north of Kelowna. Local lepidopterists in the North Okanagan have been intensively surveying the area for fifteen years without sighting Behr's Hairstreak. antelope-brush is also found in the southern Rocky Mountain Trench, but the butterfly has not been recorded there or in adjacent northern Idaho and northwest Montana (Guppy and Shepard, in press). The range of the British Columbia subspecies, *S. b. columbia*, extends south to Washington and Oregon along the eastern edges of the Cascade Mountains.

4.5 Protection and Status

Except for two small ecological reserves (Field's Lease and Haynes' Lease Ecological Reserves), small tracts within the South Okanagan Wildlife Management Area, and small areas within the complex of protected lands around Vaseux Lake, none of the antelope-brush steppe habitat required by the Behr's Hairstreak is currently protected. To make matters worse, the antelope-brush within the Haynes' Lease Ecological Reserve was recently virtually wiped out by a catastrophic fire. The best habitat left is in the Osoyoos Indian Reserve northeast of Osoyoos, adjacent to Osoyoos Lake. Recently, however, large vineyards have eliminated antelope-brush habitat in the northern part of the lakeside benchland there, and development proposals for the southern benchlands threaten the habitat in that area. In a similar situation at Fort Spokane, Washington, half of the remaining antelope-brush habitat on the Columbia River upstream of Grand Coulee Dam was eliminated in the last five years as a result of the construction of a casino and associated campground and marina.

Currently, there are no laws in British Columbia to directly protect endangered or threatened species of butterflies even if they are recognized. The only possible laws that would apply are the provincial *Parks Act*, the *Ecological Reserves Act* and the *Forest Practices Code Act of British Columbia*. The last deals primarily with land managed by the provincial government and does not yet specify that this or other insect species are to be protected, and its implementation is dependent on local managers.

Behr's Hairstreak is ranked as G5 N2N3 S2, and thus is on the provincial Red List of candidate species for threatened status.

4.6 Population Size and Trend

In 1995, when Dennis St. John surveyed the Okanagan Valley (St. John 1996), this species was found at eight sites throughout the known British Columbia range of the butterfly species. St. John gave no estimates of population size for his observations. In 1996, Shepard and Guppy (unpubl. data) found a ninth site on the east side of Osoyoos Lake where the species was very common, with over two hundred specimens at the nectar site and about one adult for every five larval foodplant shrubs. However, since then hundreds of hectares of antelope-brush steppe in the south Okanagan have been converted to vineyards in the recent expansion of the wine industry (R.J. Cannings pers. comm.), and one is forced to assume that the numbers of Behr's Hairstreaks have declined in a corresponding fashion.

4.7 Limiting Factors

This species requires a specific larval foodplant, the antelope-brush, *Purshia tridentata* (Pursh) DC. The butterfly is found virtually everywhere in the south Okanagan where the larval foodplant occurs. This species also needs a good nectar source. At the Shepard and Guppy site, several hundred Behr's Hairstreaks were observed nectaring on introduced yellow sweet clover, *Melilotus officinalis* (L.) Lam. These plants were concentrated along about one half mile of a dirt road. The individual butterflies must have come from long distances to use this nectar source. The author has also noted this phenomenon in the Columbia Basin and the Great Basin to the south, wherever this introduced plant or the related introduced white sweet-clover occur in the appropriate dry habitat. Otherwise, the native buckwheat genus *Eriogonum* is used for nectar but it is much more limited in distribution than the introduced nectar sources. It is found in small canyons and on rocky outcrops but not directly adjacent to the larval hostplant. Since the Behr's Hairstreak's habitat is much reduced from pre-European settlement, the presence of an adequate nectar source is needed to ensure healthy adults and maximum egg production.

4.8 Special Significance of the Species

This species is limited to the south Okanagan lowlands where its larval foodplant, antelope-brush, occurs. This is the one of the most imperilled

ecosystems in Canada (Schluter et al. 1995) and is home to many other species of animals and plants considered to be at risk nationally or provincially. A number of other insects are known to be obligate feeders on antelope-brush, including at least two other Lepidoptera in British Columbia: the sheep moth, *Hemileuca nuttalli*, is similarly limited to the south Okanagan Valley, whereas the geometrid moth, *Marmopteryx marmorata*, is found both in the south Okanagan and in the extreme southern Rocky Mountain Trench. The threatened status of Behr's Hairstreak highlights the decline in its habitat.

4.9 Recommendations

The provincial and federal governments should determine if any unprotected Crown lands contain good populations of Behr's Hairstreak and set them aside as ecological reserves. One such tract may be the "Oliver Mountain" site northwest of Oliver (R.J. Cannings, pers. comm.). Since very little publicly-held land contains antelope-brush habitat, privately-held lands that have good populations of Behr's Hairstreak should be acquired or managed through legal covenants or stewardship agreements with their owners. A permanent agreement should be negotiated with the Osoyoos Indian Band to protect this ecosystem within their lands.

Little is known about how to manage this habitat to maintain the antelope-brush and nectar sources. Plant ecologists should study the situation and develop a habitat management plan.

5 ISLAND BLUE

Plebejus saepiolus insulanus Blackmore
Coppers, Hairstreaks, and Blues: Lycaenidae

5.1 Taxonomic Status

Until recently, the Island Blue has been considered to be restricted to southeastern Vancouver Island. In the United States there is confusion in the application of this subspecies name. In Oregon, the name *P. s. insulanus* was applied to a few isolated populations that occur on the immediate coast (Hinchliff 1994). In Washington, there are no populations recorded for the immediate coast. The Olympic Mountains populations are classified as belonging to the subspecies *P. s. saepiolus* (Hinchliff 1996). Since subspecies are normally considered to be contiguous, similar populations (Hinchcliff 1994, 1996), usage of the name *P. s. insulanus* for the Oregon populations is incorrect. By contrast, Scott (1986) uses the subspecies name *P. s. insulanus* to apply to all *P. saepiolus* populations from northwest California through western Oregon and Washington and southwest British Columbia. This interpretation is much too inclusive. However, regardless of the taxonomic considerations elsewhere, the provincial and national status of this butterfly in British Columbia and Canada will not change. The Vancouver Island populations are a distinct subspecies found nowhere else in Canada.

5.2 Biology

The larvae of *P. saepiolus* require clovers (*Trifolium* spp.) as their specific larval foodplant (Emmel and Emmel 1973). One clover native to Vancouver Island, *T. wormskjoldii* Lehn., has been recorded as a foodplant of this butterfly species (Scott 1986). It is possible that non-native plant species have invaded disturbed sites on Vancouver Island and thus native clovers are not as common as they once were. The coastal Oregon populations of native *Trifolium* are known to be affected by weeds (P. Hammond, pers. comm.).

Little is known about the biology of the Island Blue. Museum data indicate that the butterfly had a single generation per year with the adults flying from late May to early August, depending on elevation and the time when warm spring weather begins on Vancouver Island.

5.3 Habitat

Nothing is known about the habitat on Vancouver Island. Elsewhere, the adults and larvae of *P. saepiolus* are normally found near or on the host plant, clover (*Trifolium* spp.), along open streams and moist disturbed sites, such as old roads or campgrounds.

5.4 Distribution

The Island Blue was found only on Vancouver Island, British Columbia. Historically this has been considered its world distribution (Jones 1951). Recent application of the name *P. s. insulanus* to coastal Oregon populations of *P. saepiolus* (Hinchliff 1994) but not to coastal Washington populations (Hinchliff 1996) must be an error. Museum records indicate that *P. s. insulanus* occurred only on the east side of Vancouver Island from Saratoga Beach, south of Campbell River, south to Victoria (Figure 4).

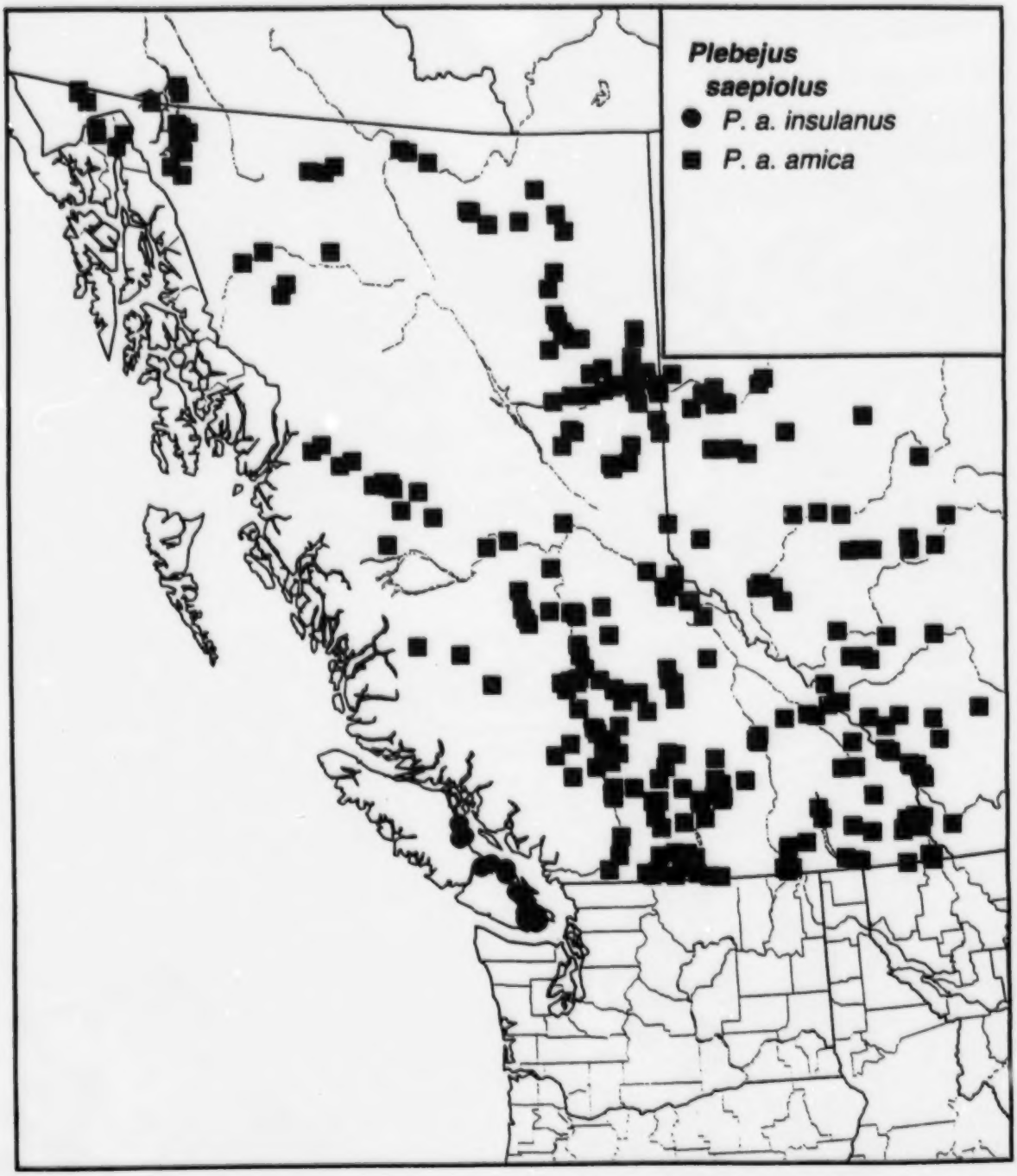

Figure 4. Distribution of *Plebejus saepiolus* in British Columbia.

5.5 Protection and Status

There are no known records of the *P. s. insulanus* since 1979 (Appendix 5). In 1995, this butterfly was not encountered in an extensive field survey of appropriate habitat throughout southeastern Vancouver Island north to Comox (Shepard 1996). However, there is still a possibility that it may be found in unsurveyed appropriate habitat. Thus the Conservation Data Centre status is revised to G5TH NH SH, which means that there are no recent records and extinction is a definite possibility.

Since Vancouver Island north of Comox has never been surveyed at the peak flight time for the Island Blue, there is a remote possibility that the butterfly may exist there.

5.6 Population Size and Trend

Since the Island Blue has not been seen since 1979, and since the data from earlier years is not extensive, population size and trends are unknown. The subspecies may be extinct.

5.7 Limiting Factors

P. saepiolus requires clovers (*Trifolium* spp.) as its larval foodplant (Emmel and Emmel 1973). Other subspecies of the butterfly range widely in Canada and the United States and no other limiting factors are known.

5.8 Special Significance of the Subspecies

This subspecies is (or was) endemic to Vancouver Island. The recent rarity of this particular subspecies probably reflects the successful spread of many introduced weed species which grow in disturbed sites. This butterfly has similar requirements to the Dun Skipper, *Euphyes vestris vestris*, another imperiled butterfly.

5.9 Recommendations

Until an extant population is located, there are no specific management recommendations. If future field work discovers a population, the habitat of that population should be immediately protected. If any United States populations can be assigned to the Island Blue subspecies, it would be possible to attempt to re-establish populations of the butterfly on Vancouver Island. It is the opinion of the author, however, that none of the populations in the United States belong to the same subspecies as the Island Blue.

6 TAYLOR'S CHECKERSPOT

Euphydryas editha taylori (W.H. Edwards)
Brush-footed Butterflies: Family Nymphalidae

6.1 Taxonomic Status

Euphydryas editha taylori has been recognized as a valid subspecies by every authority since it was described in 1888. The species consists of a large array of subspecies that fall into three groups (Bauer 1975). The three groups are found in 1) the Great Basin and Rocky Mountains; 2) the Cascade and Sierra Mountains; and 3) the coast ranges from Baja California Norte, Mexico north to southeast Vancouver Island. *E. e. taylori* belongs to the group of related coastal subspecies but is disjunct from the others in its group and would never be synonymized. Even if all coast range subspecies were to be synonymized under one subspecies, they are all considered to be as endangered as Taylor's Checkerspot. Both *E. e. quino* (Behr) [= *E. e. wrighti* Gunder (Emmel et al., 1998)] from the San Diego area and *E. e. bayensis* Sternitzky from south of San Francisco are listed as endangered by the U.S. Fish and Wildlife Service. *E. e. insularis* T. and J. Emmel is limited to Santa Rosa Island, California, and *E. e. baroni* (Edwards) from north of San Francisco has not been listed in the U.S.A., but should be.

6.2 Biology

As a species, *Euphydryas editha* (Boisduval) is one of the most intensely studied of North American butterfly species. This is the result of the studies of P. R. Ehrlich and associates carried out in the central coast ranges of California, beginning with Ehrlich (1961). These studies have concentrated on *E. e. bayensis*, a plantain (*Plantago*) feeding subspecies, and have included another *Plantago* feeding subspecies, *E. e. wrighti*, from the San Diego area.

These studies show that the larvae of *E. e. bayensis* feed primarily on *Plantago erecta* E. Morris and the larvae of *E. e. wrighti* feed on *Plantago insularis* Eastw. (Ehrlich and Murphy 1981). In drought years, the secondary larval foodplant, *Orthocarpus densiflorus* Benth., a serpentine soil obligate, is important for the survival of *E. e. bayensis* (Ehrlich 1979). Elsewhere in the range of *E. editha*, outside the immediate Pacific Coast, the larvae feed on other Scrophulariaceae (figworts) (Ehrlich and Murphy 1981). Also, where the introduced *Plantago lanceolata* L. occurs, larvae of *E. editha* feed on it. The *Plantago* and figworts share an unusual group of chemicals, the iridoid glycosides that, at least for the related species *Euphydryas*

chalcedona, stimulate oviposition (Ehrlich and Murphy 1981).

Populations of *E. e. bayensis* are confined to *Plantago erecta* growing on serpentine soil (Johnson et al. 1968) despite the presence of *Plantago erecta* growing in nearby non-serpentine areas. It was later found that the real reason for the restriction of *E. e. bayensis* to serpentine soils was the larva's dependence on the secondary food source, *Orthocarpus densiflorus* (Ehrlich 1979; Ehrlich et al. 1980). In a dry years, the larvae switch to this secondary plant after the *plantago* has withered.

Initial studies by Ehrlich (1961) indicated that *E. e. bayensis* had "intrinsic barriers" to dispersal and only move 200 to 300 feet (60-100m) from point of first observation. More recent work has shown that under stress of drought, *E. e. bayensis* will disperse more widely (Ehrlich et al. 1980) and under stress of high density *E. e. wrighti* will also disperse more widely (Murphy and White 1984).

Egg production in *E. e. bayensis* has been shown to be very dependent on available nectar sources (Murphy et al. 1983). *Lomatium macrocarpum* (H. & A.) Coult. & Rose, *Lasthenia californica* DC, *Layia platyglossa* (F. & M.) A. Gray and *Linanthus androsaceous* (Benth.) E. Greene were the nectar sources used by *E. e. bayensis*. When nectar is plentiful, up to double the number of eggs are laid (D. Murphy, pers. comm.).

There appear to be no density dependent factors, such as predators or parasites, that reduce population numbers of *E. editha*. Instead, most young larvae fail to reach summer diapause and die. Population survival depends on the production of large numbers of larvae, so that some of them grow to adequate size and diapause. Thus small pockets of the *Plantago* feeding populations are very unlikely to survive in any but the short or medium term. When they die out in years of drought, the remaining viable populations must repopulate habitat of extirpated populations (Murphy and Weiss 1988). Density dependent factors have not necessarily been completely ruled out, however. One tachinid fly, *Siphosturmia confusa* Reinhard has been reared as a parasite on *E. e. taylori* (Tothill 1913).

Shepard found three species of *Plantago* at the Helliwell Park site and elsewhere on Vancouver Island. Larvae were found feeding on *Plantago maritima* L. at Helliwell Park. In a lab situation, they were brought to maturity on *Plantago major* L., an introduced species. They were nearly ready to pupate when taken from the wild and it is not certain that Taylor's Checkerspot will feed on *Plantago major* in the wild. The third plantain, *Plantago lanceolata*, is also an introduced species. The Mill Bay Road population used *Plantago lanceolata*. Oregon populations of Taylor's Checkerspot are also known to feed on the introduced *Plantago lanceolata* (E.J. Dornfeld, pers. comm.). There is no serpentine soil where *E. e. taylori* occurs on Vancouver Island and *Orthocarpus densiflorus*, the alternate food plant in California, is not found in British Columbia. There are other annual *Orthocarpus* spp. on Vancouver Island, but it has not been determined if any occur at Helliwell Park.

At the Helliwell Park site, adult Taylor's Checkerspots take nectar from spring gold, *Lomatium utriculatum* (T. & G.) J. Coulter & Rose. This plant no longer exists or is very rare at the historic Greater Victoria sites. There, spring gold appears to have been reduced by competition from introduced grasses. At the Shawnigan Lake (Mill Bay Road site, no *Lomatium* species was ever present and adults used wild strawberry.

6.3 Habitat

Taylor's Checkerspot requires open grassland with sparse vegetation where foodplants for larvae and nectar sources for adults are available. Often these are the driest and rockiest areas around Garry oaks. The only surviving population of the Taylor's Checkerspot in British Columbia occurs on a very porous, sedimentary, sea cliff substrate where all moisture drains quickly.

6.4 Distribution

The historic distribution of *Euphydryas editha taylori* was southeastern Vancouver Island, the Puget Trough in Washington from Tenino north through the San Juan Islands, and the Willamette Valley in Oregon. The historic distribution in Canada included ten sites in the greater Victoria area, one site on the Mill Bay to Shawnigan Lake Road and on Hornby Island. The subspecies is presently known to exist in Canada on Hornby Island, BC. The main Hornby population is in Helliwell Provincial Park, with a small, secondary population in nearby Tribune Bay Provincial Park. An additional, small, secondary population is several kilometres away on a powerline right-of-way near Norman Point on the southwestern corner of Hornby Island (Figure 5, Appendix 6).

6.5 Protection and Status

The only known extant, viable population is almost completely within the boundaries of Helliwell Provincial Park, thus it is protected from collection

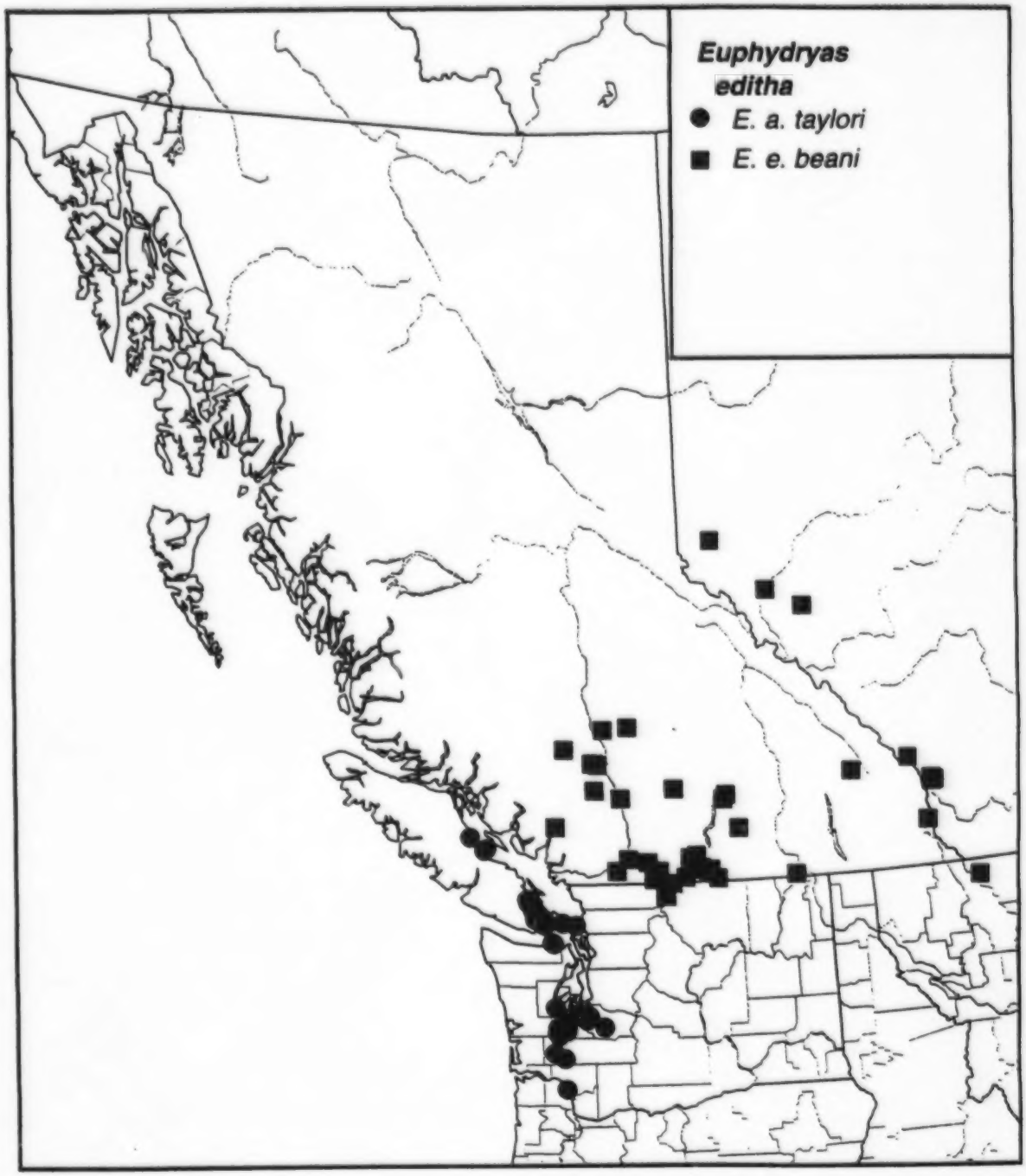

Figure 5. Distribution of *Euphydryas editha* in British Columbia and adjacent Washington (USA).

and urbanization of its habitat. A local citizens group, the Hornby Island chapter of the Island Conservancy, are aware of the importance of control of non-native plant species and have organized voluntary scotch broom removal on the Island. However, B.C. Parks have no plans in place for continued monitoring of the population of the Taylor's Checkerspot or its habitat. Currently there are no laws in British Columbia to directly protect endangered or threatened species of butterflies even if they are recognized. The only possible laws that would apply in this butterfly's case are the provincial *Parks Act* and the *Ecological Reserves Act*.

The present Conservation Data Centre ranking is G5T1 N1 S1. The subspecies is almost extinct in Oregon and has a limited distribution in Washington, with only three or four declining populations (A. Potter, pers. comm.) near Tenino, at Fort Lewis and at Dungeness National Wildlife Refuge near Sequim. The Nature Conservancy of Washington has bought key habitat for Taylor's Checkerspot and other Garry oak meadow species in the Tenino area as urbanization approaches that area from Olympia.

6.6 Population Size and Trend.

Shepard estimated the Hornby Island population size in 1995 by a transect count (Pollard 1977). The population was conservatively estimated at 1100 individuals. The site was revisited by Shepard in 1996 and the population appeared to be the same size. This is consistent with that of viable populations of the species in California (Ehrlich 1961). Hanski et al. (1995) show that smaller populations of similar checkerspot species in Finland and Sweden periodically die out and are repopulated by the larger metapopulations.

Parmesan (1996) attributed the increased loss of *Euphydryas editha* populations to global warming. However, at least in Oregon, Washington, and British Columbia there have been no populations lost where global warming was a potential factor. The Shawnigan Lake to Mill Bay Road population was lost due to scotch broom invasion. The Oregon populations were also lost due to weed invasion and forest succession in McDonald Forest, owned by Oregon State University, before global warming became a factor.

The Shawnigan Lake to Mill Bay road population was stable while the power line right-of-way was used as a Christmas tree farm. In 1989, C.S. Guppy (pers. comm.) gave a very rough estimate of 1000 individuals for this population. However, when the right-of-way was no longer managed for Christmas tree production, scotch broom quickly invaded and the population became extirpated.

The extirpated populations near Victoria have disappeared since the 1960s and one can only speculate about the cause of their loss. Examination of the habitat of the large population at Beacon Hill Park in Victoria indicates that the invasion of introduced weeds has all but eliminated the nectar source, *Lomatium utriculatum*, which is essential to maintain adult Taylor's Checkerspot butterflies. In 1995 Shepard was able to locate only three plants of *Lomatium utriculatum* at Beacon Hill Park. No native *Plantago* species could be found but introduced *Plantago* species were abundant. There is some circumstantial information that the Taylor's Checkerspot population at Beacon Hill Park was most abundant along the top of the sea cliffs and not the open slopes of the hill to the fire beacon. If so, that habitat has been affected mostly by road paving and sidewalks. Guppy (pers. comm.) noted wild strawberries as a nectar source at the Mill Bay Road site, but that is not a normal nectar source.

6.7 Limiting Factors

In British Columbia, *E. e. taylori* requires specific larval foodplants (*Plantago* spp.) and possibly certain Scrophulariaceae, and a specific adult nectar source, *Lomatium* sp., to maintain viable populations. In south coastal British Columbia these requirements are fulfilled by Garry oak meadow ecosystems and adjacent open grasslands. Invasion of these communities by introduced plants, fire suppression, and habitat destruction through urbanization are the main threats to the Taylor's Checkerspot.

6.8 Special Significance of the Subspecies

The Taylor's Checkerspot is confined to Garry oak meadow habitat, an endangered ecosystem essentially restricted to southeastern Vancouver Island and the Gulf Islands in Canada, and home to many other species at risk. The virtual elimination of this subspecies from its global range highlights the plight of this habitat throughout the Pacific Northwest.

6.9 Recommendations

The biology of this butterfly should be studied in detail to determine how best to manage it at the Helliwell Park site and also to reintroduce it to former habitat. It must be determined if an alternative host, to which larvae can switch after the *Plantago* dries in years of drought, is ever used in British Columbia. It

would also help in management planning to determine if parasites are a significant factor in controlling population numbers.

At the site of the one viable population, the plant community should be managed to eliminate all introduced weeds. The continued support of the local Island Conservancy group in controlling scotch broom is absolutely essential. Also the plant community should be monitored on an annual basis to determine if fire suppression is resulting in plant succession that will eliminate either the larval foodplant, *Plantago maritima*, or the adult nectar source, *Lomatium utriculatum*. If either plant is found to be decreasing in density, immediate action must be taken to find the cause and reverse the situation.

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Appendix 1. 2000 Red and Blue list of British Columbia butterflies.

Global and provincial ranks are presented using the methodology of the B.C. Conservation Data Centre developed by The Nature Conservancy (U.S.), where 1 is the rank given to the rarest or most endangered taxa and 5 is the rank given to the most common taxa. For more information on this ranking system, see Fraser et al. (1999).

Scientific Name	Common Name	Global Rank	Prov. Rank	List status
Erynnis propertius	Propertius Duskywing	G5	S3	BLUE
Erynnis afranius	Afranius Duskywing	G5	S1	RED
Carterocephalus palaemon mandan			S3	BLUE
Hesperia comma assiniboia		G5T5	S3	BLUE
Hesperia comma oregonia		G5T4	S3	BLUE
Polites sabuleti	Sandhill Skipper	G5	S3	BLUE
Polites draco	Draco Skipper	G5	S3	BLUE
Polites sonora	Sonora Skipper	G4	S1	RED
Euphyes vestris	Dun Skipper	G5	S2	RED
Parnassius clodius altaurus	Altaurus Parnassian	G5T3?	S3S4	BLUE
Parnassius phoebus	Phoebus Parnassian	G5	S2S3	BLUE
Papilio bairdii pikei	Peace River Swallowtail	G5T3	S3	BLUE
Papilio indra	Indra Swallowtail	G5	S1S2	RED
Pieris guppyi guppyi	Skagway White	G5T3	S3	BLUE
Pieris angelika	Arctic White	G5	S3	BLUE
Euchloe ausonides ssp 1	Island Large Marble	G5T1T2	SX	RED
Colias occidentalis	Western Sulphur	G3G4	S3S4	BLUE
Colias meadii	Mead's Sulphur	G4G5T4	S3	BLUE
Colias hecla	Hecla Sulphur	G5	S2S3	BLUE
Colias gigantea gigantea	Giant Sulphur		S2S3	BLUE
Lycaena dione	Gray Copper	G5	S1	RED
Lycaena hyllus	Bronze Copper	G5	S2S3	BLUE
Lycaena nivalis	Nivalis Copper	G5	S3	BLUE
Satyrium behrii	Behr's Hairstreak	G5	S1S2	RED
Satyrium fuliginosum	Sooty Hairstreak	G4	S1	RED
Satyrium californicum	California Hairstreak	G5	S3	BLUE
Satyrium liparops	Striped Hairstreak	G5	S2	RED
Satyrium titus immaculosus			S3S4	BLUE
Satyrium titus titus	Coral Hairstreak		S2S3	BLUE
Callophrys affinis	Immaculate Green Hairstreak	G5	S3	BLUE
Loranthomitoura johnsoni	Johnson's Hairstreak	G2G3	S1S2	RED
Incisalia mossii mossii	Moss' Elfin	G3G4T4	S3	BLUE
Incisalia niphon	Eastern Pine Elfin	G5	S1S3	RED
Everes comyntas	Eastern Tailed Blue	G5	S2S3	BLUE
Plebejus saepiolus insulanus	Vancouver Island Blue	G5TH	SH	RED
Icaricia icarioides blackmorei	Blackmore's Blue	G5T3	S3	BLUE
Vacciniina optilete	Cranberry Blue	G5	S3	BLUE
Agriades glandon lacustris			S3	BLUE
Apodemia mormo	Mormon Metalmark	G5	S1	RED
Speyeria cybele pseudocarpenteri	Chermock's Fritillary	G5T5	S3	BLUE
Speyeria aphrodite whitehousei	Whitehouse's Fritillary	G5T4	S3S4	BLUE

Appendix 1 (Continued).

Scientific Name	Common Name	Global Rank	Prov. Rank	List status
Speyeria aphrodite manitoba	Manitoba Fritillary	G5T5	S3	BLUE
Speyeria coronis	Coronis Fritillary	G5	SRF	N/A
Speyeria zerene bremnerii	Bremner's Silverspot	G5T3T4	S3	BLUE
Speyeria zerene garretti	Garrett's Fritillary	G5T3	S3	BLUE
Speyeria egleis	Egleis Fritillary	G5	SRF	N/A
Speyeria mormonia erinna			S1S2	RED
Boloria natazhati	Natazhati Fritillary	G2G3	S2S3	BLUE
Boloria alberta	Alberta Fritillary	G3	S3	BLUE
Boloria astarte distincta	Distinct Fritillary	G5T3	S3	BLUE
Charidryas palla sterope		G5	S2S3	BLUE
Charidryas hoffmanni	Hoffman's Checkerspot	G4	S3	BLUE
Phyciodes batesii	Tawny Crescent	G4	S3	BLUE
Euphydryas gillettii	Gillette's Checkerspot	G2G3	S2	RED
Euphydryas anicia helvia	Helvia Checkerspot	G5T4	SRF	N/A
Euphydryas editha taylori	Taylor's Checkerspot	G5T1	S1	RED
Limenitis archippus	Viceroy	G5	SX	RED
Coenonympha california benjamini	Prairie Ringlet	G5T5	S3	BLUE
Coenonympha california insulana	Vancouver Island Ringlet	G5T3T4	S2S3	BLUE
Cercyonis pegala incana		G5T3	S3	BLUE
Cercyonis pegala ino	Hall's Wood Nymph	G5T5	S3	BLUE
Cercyonis oetus charon		G5T5	S1	RED
Erebia magdalena	Magdalena Alpine	G5	S2S3	BLUE
Erebia mackinleyensis	Mt. McKinley Alpine	G4	S2S3	BLUE
Erebia discoidalis	Red-disked Alpine	G5	S3S4	BLUE
Erebia pawlawskii	Mountain Alpine	G5	S2S3	BLUE
Oeneis uhleri	Uhler's Arctic	G5	S3	BLUE
Oeneis alberta	Alberta Arctic	G4	S2	RED
Oeneis bore edwardsi	Edward's Arctic	G5T3	S3	BLUE
Oeneis jutta alaskensis		G5T5	S3	BLUE
Oeneis polixenes yukonensis	Yukon Polixenes Arctic	G5T5	S3	BLUE
Oeneis rosovi	Philip's Arctic	GU	S2S3	BLUE
Danaus plexippus	Monarch	G5	S3B, SZN	BLUE

Appendix 2. British Columbia collection records for *Euphyes vestris*.
CNC: Canadian National Collection, Agriculture Canada, Ottawa; RBCM: Royal British Columbia Museum, Victoria; UBC: Spencer Entomological Museum, Department of Zoology, University of British Columbia, Vancouver; WSU: Washington State University, Pullman; AMNH: American Museum of Natural History, New York; NK: Norbert Kondla, Castlegar; JHS: Jon Shepard, Nelson; CSG: Cris Guppy, Quesnel; Jones: record in Jones (1951) not confirmed with a known specimen; CAS: California Academy of Sciences, San Francisco.

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Bevan	125 05	49 39	120'	1933	7	6	J. McDunnough	CNC	1	0
Boston Bar	121 26	49 52		1949	6	5	John K. Cooper	RBCM	1	0
Boston Bar	121 26	49 52		1949	6	6	John K. Cooper	RBCM	2	0
Boston Bar, 21 km N				1998	6	8	N. Kondla	NK	2	1
Francis Park	123 26 38	48 29 10	80'	1962	7	2	G. A. Hardy	RBCM	2	0
Francis Park	123 26 38	48 29 10	80'	1962	7	9	G. A. Hardy	RBCM	1	0
Francis Park	123 26 38	48 29 10	80'	1962	7	16	G. A. Hardy	RBCM	1	0
Francis Park	123 26 38	48 29 10	80'	1962	7	22	G. A. Hardy	RBCM	1	0
Francis Park	123 26 38	48 29 10	80'	1962	7	27	G. A. Hardy	RBCM	1	0
Goldstream	123 33 00	48 28 00	80'	1902	7	2	E. H. Blackmore	UBC	1	0
Goldstream	123 33 00	48 28 00	80'	1902	7	3	E. H. Blackmore	UBC	0	1
Goldstream	123 33 00	48 28 00	80'	1902	7	20	Blackmore Coll.	UBC	1	0
Goldstream	123 33 00	48 28 00	80'	1902	7	27	Blackmore Coll.	UBC	0	1
Goldstream	123 33 00	48 28 00	80'	1904	7	1		RBCM	1	0
Goldstream	123 33 00	48 28 00	80'	1904	7	19		RBCM	1	0
Goldstream	123 33 00	48 28 00	80'	1923	6	17	K. F. Auden	UBC	1	0
Goldstream	123 33 00	48 28 00	80'	1923	6	24	K. F. Auden	UBC	0	1
Goldstream	123 33 00	48 28 00	80'	1923	7	11	J. F. G. Clarke	WSU	1	0
Hope	121 27 00	49 23 00		1918	6	23	W. B. Anderson	UBC	1	0
Lillooet	121 56	50 41	1000'	1981	7	18	J. and S. Shepard	JHS	1	0
Lytton	121 34	50 14		1988	7	3		RBCM	0	1
Lytton, 26kmS	121 30 00	50 00 00		1988	7	3	G. E. Hutchings	RBCM	0	1
Maple Bay	123 36 47	49 48 59		1922	6	27		RBCM	1	0
Maple Bay	123 36 47	49 48 59		1933	7	13	J. McDunnough	CNC	2	0
Mission				1919	8	20		UBC	0	1
Mt. Prevost	123 46 01	48 49 34	740'	1956	7	7	G. A. Hardy	RBCM	2	0
Mt. Prevost	123 46 01	48 49 34	740'	1956	7	14	G. A. Hardy	RBCM	2	0
Mt. Sicker	123 43	48 51		1954	6	24	Richard Guppy	AMNH	0	1
Mt. Sicker	123 43	48 51		1963	5	28	Richard Guppy	AMNH	1	0
Mt. Sicker	123 43	48 51		1963	6	22	Richard Guppy	AMNH	1	1
Mt. Sicker				1976	7	23	R. Guppy	NK	1	0
Nanaimo L. Rd.	124 13	49 06	220m	1988	6	25	C. S. Guppy	CSG	1	0
Pemberton, nr.	122 48	50 19		1968	7	8	J. W. Tilden	CAS	2	0
Powell River	124 32	49 51						Jones	[1]	0
Sahtlam Dist.	123 48 01	48 46	100'	1932	7	7	J. R. L. Jones	UBC	1	0
Sahtlam Dist.	123 48 01	48 46	100'	1932	8	17	J. R. L. Jones	UBC	1	0
Somenos				1977	7	13	R. Guppy	NK	1	0
Somenos				1978	7	14	R. Guppy	NK	1	0

Appendix 2 (Continued).

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Somenos				1976	7	30	R. Guppy	NK	1	0
Spectacle Lake	123 34	48 35	380'	1956	7	5	G. A. Hardy	RBCM	0	1
Spectacle Lake	123 34	48 35		1963	6	5	G. A. Hardy	RBCM	1	0
Thetis Lake Park	123 28 24	48 27 58	40'	1962	7	21	G. A. Hardy	RBCM	2	0
Thetis Lake Park	123 28 24	48 27 58	40'	1963	7	16	G. A. Hardy	RBCM	1	0
Wellington	124 02	49 12	100'	1951	6	26	R. Guppy	CAS	1	0
Wellington	124 02	49 12		1951	6	26	R. Guppy	CAS	1	0
Wellington	124 02	49 12	100'	1960	8	5	R. Guppy	CAS	0	1
Wellington	124 02	49 12		1960	8	5	R. Guppy	CAS	0	1
Wellington	124 02	49 12		1963	7	26	Richard Guppy	AMNH	1	0
Wellington	124 02	49 12		1979	6	24	R. Guppy	NK	1	0
Yale				1998	6	22	D. Threatful	NK	1	0

Appendix 3. British Columbia collection records for the Island Marble, an undescribed subspecies of *Euchloe ausonides*.

CNC: Canadian National Collection, Agriculture Canada, Ottawa; RBCM: Royal British Columbia Museum, Victoria; UBC: Spencer Entomological Museum, Department of Zoology, University of British Columbia, Vancouver; NMNH: National Museum of Natural History, Washington, DC; JHS: Jon Shepard, Nelson.

Location	Approx. longitude	Approx. latitude	Year	Month	Day	Collector	Museum	Male	Female
Beacon Hill Park	123 21 54	48 24 48	1898	5	17	E. M. A[nderson].	RBCM	0	1
B[eacon].H[ill]. P.	123 21 54	48 24 48	1899	5	28	E. M. A[nderson].	RBCM	1	0
Gabriola Is., S.	123 49	49 09	1908	5	30	B. R. Elliott	JHS	1	0
James Bay	123 21 54	48 24 48	1898	5	17	E. M. A[nderson].	RBCM	1	0
Langford	123 29 47	48 26 56	1898	5	27	E. M. A[nderson].	RBCM	0	1
Vancouver [Is]	123 07 00	49 14 59	1861			Dr. Lyle,25/252. [59.7]	BMNH	1	0
Victoria	123 22 43	48 25 50	1882	5	26		CNC	0	1
Victoria	123 22 43	48 25 50	1885	4	25		CNC	1	0
Victoria	123 22 43	48 25 50	1904	5	11		CNC	1	0
Victoria	123 22 43	48 25 50	1905	5	24	J. Fletcher	NMNH	0	1
Victoria	123 22 43	48 25 50	1987	5	28		NMNH	1	0
Wellington	124 02	49 12	1904	6	3	G. W. Taylor	CNC	0	1
[Victoria]	123 22 43	48 25 50					UBC	0	1
[Victoria]	123 22 43	48 25 50					UBC	1	0

Appendix 4. British Columbia records for *Satyrium behrii*.

CNC: Canadian National Collection, Agriculture Canada, Ottawa; RBCM: Royal British Columbia Museum, Victoria; UBC: Spencer Entomological Museum, Department of Zoology, University of British Columbia, Vancouver; AMNH: American Museum of Natural History, New York; JHS: Jon Shepard, Nelson; CSG: Cris Guppy, Quesnel; NK: Norbert Kondla, Castlegar; CAS: California Academy of Sciences, San Francisco; DT: David Threatful, Vernon. Specimen numbers in square brackets refer to either sight records or specimens not confirmed or sexed by the author.

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Anarchist Mt.	119 25	49 00	1000'	1976	7	4	J. and S. Shepard	CSG	3	1
Fairview	119 36 05	49 10 25		1919	6	12	W. B. Anderson	UBC	1	0
Fairview	119 36	49 11	1500'	1996	7	1	C. S. Guppy	CSG	1	0
Fairview/White L. Rd.	119.5934	49.1782		1995	6	15	R. D. St. John		[1]	0
Inkaneep PP	119 32	49 14		1995	6	9	R. D. St. John		[1]	0
Jct. Hwy. 3A/97	119.6082	49.3821		1995	6	25	R. D. St. John		[1]	0
McIntyre Bluff	119.5231	49.2535		1995	6		R. D. St. John		[1]	0
McLean Cr.	119 33 50	49 22 30		1995	6	21	R. D. St. John		[1]	0
Mld. [Osoyoos]	119 28	49 02		1898	5	24	E. M. A[nderson].	RBCM	0	1
Mld. [Osoyoos]	119 28	49 02		1901	6	29	E. Anderson	RBCM	[1]	0
Mld. [Osoyoos]	119 28	49 02		1901	6	29	E. M. A[nderson].	RBCM	1	0
Okanagan Falls	119 34 43	49 20 33		1995	6	21	R. D. St. John		[1]	0
Okanagan Falls	119 34 43	49 20 33			6	21	C. Garrett	AMNH	0	1
Oliver	119 32 59	49 10 58		1953	7	23	J. R. McGillis	CNC	0	1
Osoyoos	119 27	49 02		1895	7	23		CNC	0	1
Osoyoos	119 27	49 02		1919	6	10	W. B. Anderson	CNC	1	1
Osoyoos	119 27	49 02		1919	6	10	W. B. Anderson	UBC	1	0
Osoyoos	119 27	49 02		1919	6	12	W. B. Anderson	CNC	1	0
Osoyoos	119 27	49 02		1919	6	12	W. B. Anderson	CNC	1	0
Osoyoos Lake	119 27	49 03	1000'	1996	6	30	C. S. Guppy	CSG	4	5
Osoyoos, 2mSE	119 27	49 02	1000'	1976	7	4	J. and S. Shepard	JHS	10	0
Oliver, 5 km N				1999	6	17	D. Threatful	NK	46	♀
Penticton Dist.	119 35 00	49 30 00			6	10	Blackmore Coll.	UBC	1	0
Sigalet Rd, Mabel L.	118 48	50 21	3000'	1969	6	16	PRE	AMNH	1	0
Vaseux L.	119 32	49 17		1972	6	18	D. L. Threatful	DT	[1]	0
Vaseux L., W	119 32	49 17		1995	6	15	R. D. St. John		[1]	0
Veronica/Hwy. 3	119.4068	49.0081		1995	6	28	R. D. St. John		[1]	0

Appendix 5. British Columbia collection records for *Plebejus saepiolus insulanus*.
CNC: Canadian National Collection, Agriculture Canada, Ottawa; RBCM: Royal British Columbia Museum, Victoria (specimen numbers in square brackets refer to specimens not checked or sexed by the author); AMNH: American Museum of Natural History, New York; QM: Quesnel Museum; NK: Norbert Kondla, Castlegar; CAS: California Academy of Sciences, San Francisco.

Locality	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Bare Mt.	123 19	48 27		1933	6	15	J. McDunnough	CNC	1	0
Bevan	125 05	49 39		1933	7	6	J. McDunnough	CNC	5	1
Bevan	125 05	49 39		1933	8	6	J. McDunnough	AMNH	1	0
Big Sicker Mt.	123 45 24	48 51 41		1916	7	3		RBCM	1	0
Copper Canyon	123 48 02	48 52 51		1916	7	1		RBCM	1	0
Courtenay	124 59	49 41		1931	6	5	dos Passos Coll.	AMNH	3	1
Courtenay	124 59	49 41		1933	6	27	J. McDunnough	AMNH	2	0
Courtenay	124 59	49 41		1933	6	27	J. McDunnough	CNC	8	0
Courtenay	124 59	49 41		1933	7	3	J. McDunnough	AMNH	3	0
Courtenay	124 59	49 41		1933	7	4	J. McDunnough	CNC	6	0
Errington	124 22 00	49 16 59		1927	7	1	G. H. Larnder	RBCM	2	0
Errington	124 22 00	49 16 59		1927	7	4	G. H. Larnder	RBCM	0	2
Errington	124 22 00	49 16 59		1927	7	5	G. H. Larnder	RBCM	1	0
Errington	124 22 00	49 16 59		1927	7	10	G. H. Larnder	RBCM	1	0
Esquimalt	123 26	48 27		1909	6	17	A. J. Croker	AMNH	0	1
Fitzgerald	123 36 27	48 34 41		1921	6	3	[L. J. Lewis]	QM	0	1
Fitzgerald	123 36	48 35	220m	1921	6	3	Lewis J. Clark	QM	0	2
Fitzgerald	123 36 27	48 34 41		1921	6	9	L. J. Lewis	QM	0	1
Francis Park	123 36 38	48 29 10		1963	5	27	G. A. Hardy	RBCM	2	0
Francis Park	123 36 38	48 29 10		1963	6	6	G. A. Hardy	RBCM	2	0
Goldstream	123 33 06	48 27 15		1903	5	24		RBCM	3	5
Goldstream	123 33 06	48 27 15		1904	5	15		RBCM	0	1
Goldstream	123 33 00	48 28 00		1918	5	31	E. H. Blackmore	CNC	1	0
Goldstream	123 33 06	48 27 15		1919	5	31		RBCM	0	1
Goldstream	123 33 06	48 27 15		1919	5	31	G. O. Day	RBCM	[1]	0
Goldstream	123 33 06	48 27 15		1919	6	8		RBCM	0	1
Goldstream	123 33 06	48 27 15		1920	5	31	G. O. Day	RBCM	[1]	0
Goldstream	123 33 06	48 27 15		1921	5	21	G. O. Day	RBCM	[1]	0
Goldstream	123 33 00	48 28 00		1926	4	28	W. Downes	CNC	1	1
Lost Lake	123 21 21	48 28 42		1924	6	8	W. H. A. Preece	AMNH	1	0
Malahat	123 35 08	48 33 46		1952	7	10	G. A. Hardy	RBCM	1	0
Malahat	123 35 08	48 33 46		1960	6	17	G. A. Hardy	RBCM	2	0
Malahat	123 35 08	48 33 46		1961	6	16	G. A. Hardy	RBCM	[1]	0
Malahat	123 35 08	48 33 46		1961	6	22	G. A. Hardy	RBCM	2	0
Malahat				1979	6	24	R. Guppy	NK	2	0
Mt. Arrowsmith	124 23	49 15		1962	8	20	R. Guppy	CAS	1	0
Mt. Arrowsmith	124 23	49 15		1963	8	9	Richard Guppy	AMNH	0	1
Mt. Benson	124 02	49 08		1962	8	14	R. Guppy	CAS	0	1
Mt. Finlayson	123 32 14	48 29 44		1959	6	18	G. A. Hardy	RBCM	0	1
Mt. Finlayson	123 32 14	48 29 44		1960	5	38		RBCM	2	0
Mt. Finlayson	123 32 14	48 29 44		1960	5	28	G. A. Hardy	RBCM	1	0
Mt. Finlayson	123 32 14	48 29 44		1960	6	2	G. A. Hardy	RBCM	1	0

Appendix 5 (Continued).

Locality	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Mt. Finlayson	123 32 14	48 29 44		1960	6	8	G. A. Hardy	RBCM	3	0
Mt. Malahat	123 33	48 35		1959	6	20	R. Guppy	CAS	1	0
Mt. Sicker	123 43	48 51		1963	6	6	Richard Guppy	AMNH	0	1
Observatory Hill	123 23 28	48 30 02		1960	6	4	G. A. Hardy	RBCM	2	0
Observatory Hill	123 23 28	48 30 02		1963	6	6	G. A. Hardy	RBCM	0	1
Quamichan L.	123 40 02	48 47 59		1905	6	5	G. O. Day	RBCM	[1]	0
Royal Oak	123 23 38	48 30 02						RBCM	[1]	0
Saanich	123 22 02	48 33 01		1929	5	10	W. H. A. Preece	CNC	1	0
Saratoga Beach	125 07	49 52		1933	6	28	J. McDunnough	CNC	4	1
Saratoga Beach	125 07	49 52		1933	7	7	J. McDunnough	CNC	6	3
Shawnigan L.	123 33	48 39		1963	6	29	Richard Guppy	AMNH	1	0
Spectacle Lake	123 34 00	48 34 45		1957	5	31	G. A. Hardy	RBCM	0	1
Spectacle Lake	123 34 00	48 34 45		1960	5	24	G. A. Hardy	RBCM	0	1
Spectacle Lake	123 34 00	48 34 45		1960	6	6	G. A. Hardy	RBCM	1	0
Spectacle Lake	123 34 00	48 34 45		1964	6	14	G. A. Hardy	RBCM	1	0
Victoria	123 22 43	48 25 50		1901	7	1		RBCM	0	1
Victoria	123 22 43	48 25 50		1902	5	23		AMNH	1	0
Victoria	123 22 43	48 25 50		1903	5	16	E. M. Anderson	CNC	2	0
Victoria	123 22 43	48 25 50		1910	5	23	A. J. Croker	AMNH	2	3
Victoria	123 22 43	48 25 50		1910	5	31	A. J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1911	5	5	E. H. Blackmore	AMNH	1	0
Victoria	123 22 43	48 25 50		1911	6	11	E. H. Blackmore	AMNH	0	1
Victoria	123 22 43	48 25 50		1916	5	11	E. H. Blackmore	CNC	0	1
Victoria	123 22 43	48 25 50		1916	5	24	E. H. Blackmore	CNC	1	0
Victoria	123 22 43	48 25 50		1920	5	31	L. J. Lewis	QM	1	0
Victoria	123 21	45 24		1920	5	31	Lewis J. Clark	QM	1	0
Victoria	123 22 43	48 25 50		1921	5	12	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1921	7	7	L. J. Clark	QM	0	1
Victoria	123 21	45 24		1921	7	7	Lewis J. Clark	QM	0	1
Victoria	123 22 43	45 24			5	27	A. J. Croker	AMNH	6	1
Victoria	123 22 43	48 25 50			6	15		RBCM	1	1
Victoria	123 22 43	48 25 50			6	17		RBCM	0	1
Victoria	123 22 43	48 25 50			6	18	A. J. Croker	AMNH	3	2
Wellington	124 01 52	49 12 49		1902	6	21		RBCM	1	0
Wellington	124 01 52	49 12 49		1903	6	11		RBCM	1	0
Wellington	124 01 52	49 12 49		1904	6	25		RBCM	1	0
Wellington	124 01 52	49 12 49		1905	6	22		RBCM	0	1
Wellington	124 02	49 12		1960	7	18	R. Guppy	CAS	1	0
Wellington	124 01 52	49 12 49						RBCM	1	0

Appendix 6. British Columbia records for *Euphydryas editha taylori*.

CNC: Canadian National Collection, Agriculture Canada, Ottawa; RBCM: Royal British Columbia Museum, Victoria (specimen numbers in square brackets refer to specimens from RBCM database that have not been checked or sexed by author); UBC: Spencer Entomological Museum, Department of Zoology, University of British Columbia, Vancouver; New York; JHS: Jon Shepard, Nelson; CSG: Cris Guppy, Quesnel; NK: Norbert Kondla, Castlegar; CAS: California Academy of Sciences, San Francisco; RG: Richard Guppy, sight record, *in litt.*; Lep. Soc.: 1951 Season Summary, Lepidopterists' Society, sight record. YPMN: Peabody Museum of Natural History, Yale University, New Haven, CT.

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Beacon Hill Park	123 21 00	48 25 00			5	5	Wood Coll.	AMNH	1	1
B[eacon].H[ill]. P.	123 21	48 25		1901	5	24	E. M. Anderson	CNC	0	1
Braefoot	123 20 47	48 28 19		1952	5	7	G. A. Hardy	RBCM	1	0
Braefoot	123 20 47	48 28 19		1952	5	15	G. A. Hardy	RBCM	[1]	0
Braefoot	123 20 47	48 28 19		1953	5	11	G. A. Hardy	RBCM	0	1
Brentwood	123 27 39	48 34 17		1954	5	12	G. A. Hardy	RBCM	[1]	0
Cattle Point	123 17 22	48 26 17		1932	5	7	J. Burbridge	RBCM	[1]	0
Chain Is.	123 16 23	48 25 15		1949	5	10	G. I. Guiget	RBCM	0	1
Chain Is.	123 16 23	48 25 15		1953	5	1	G. A. Hardy	RBCM	1	0
Courtenay	124 59 00	49 41 00		1931	5	2	dos Passos Coll.	AMNH	9	1
Courtenay	124 59 00	49 41 00		1931	5	9	dos Passos Coll.	AMNH	4	2
Duncan	123 42 00	48 47 00					A. W. Hanham	CNC	1	0
Duncan, Bright Angel Park	123 41	48 44		1975			R. Guppy	RG	[many]	0
Duncan, Bright Angel Park	123 41	48 44		1977	5	1	R. Guppy	NK	3	0
Duncan, Bright Angel Park	123 41	48 44		1977	5	11	R. Guppy	NK	3	0
Duncan, Bright Angel Park	123 41	48 44		1978	5	16	R. Guppy	NK	1	0
Duncan, Bright Angel Park	123 41	48 44		1978	5	18	R. Guppy	NK	2	0
Helliwell PP	124 36 10	49 31 29		1977	4	25	J. and S. Shepard	JHS	2	11
Helliwell PP	124 36 10	49 31 29		1995	4	27	J. H. Shepard	RBCM	10	1
Helliwell PP. W	124 36 10	49 31 29		1995	4	27	J. H. Shepard	JHS	6	0
Hudson Bay Woods [Oak Bay]	123 18 10	48 26 33		1954	5	3	G. A. Hardy	RBCM	1	0
Lost Lake	123 21 36	48 29 04		1951	5	9	G. A. Hardy	RBCM	[1]	0
Lost Lake	123 21 36	48 29 04		1952	4	24	G. A. Hardy	RBCM	1	0
Lost Lake	123 21 36	48 29 04		1952	5	12	G. A. Hardy	RBCM	1	0
Lost Lake	123 21 36	48 29 04		1953	5	9	G. A. Hardy	RBCM	[1]	0
Mill Bay	123 34 22	48 38 12	190	1988	5	7	C. S. Guppy	RBCM	31	3
Mill Bay	123 33 24	48 39 17		1989	4	15	C. S. Guppy	RBCM	[1]	0
Mill Bay, 3 km SW	123 34	48 38	190m	1988	5	7	C. S. Guppy	CSG	11	1
Mill Bay, 3 km SW	123 34	48 38	190m	1988	5	20	C. S. Guppy	CSG	11	19
Mill Bay, 3 km SW	123 35 00	48 38 00		1988	5	7	C. S. Guppy	JHS	4	1
Mill Bay, 3 km SW	123 35 00	48 38 00		1988	5	20	C. S. Guppy	JHS	10	2
Mt. Douglas	123 20 38	48 29 30		1954	5	24	G. A. Hardy	RBCM	[1]	0
Mt. Finlayson	123 32 14	48 29 44		1957	5	7	G. A. Hardy	RBCM	[1]	0
Mt. Finlayson	123 32 14	48 29 44		1958	5	5	G. A. Hardy	RBCM	0	1
Norman Pt., nr.	124 39 55	49 29 32		1995	4	28	J. H. Shepard	JHS	3	0
Norman Pt., nr.	124 39 55	49 29 32		1995	4	28	J. H. Shepard	RBCM	1	0

Appendix 6 (Continued).

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Oak Bay	123 18 00	48 27 00		1951	4	24	Richard Guppy	AMNH	2	0
Oak Bay	123 18 00	48 27 00		1951	4	24	Gibbon Coll.	CNC	4	2
Oak Bay	123 18 00	48 27 00					Richard Guppy	Lep.Soc.	[common]	0
Observatory Hill	123 25 06	48 31 16		1957	5	4	G. A. Hardy	RBCM	[1]	0
Observatory Hill	123 25 06	48 31 16		1957	5	5	G. A. Hardy	RBCM	[1]	0
Royal Oak	123 23 38	48 30 02		1957	5	18	G. A. Hardy	RBCM	[1]	0
Shawnigan Dist.	123 33 14	48 39 23		1931	5	9	J. R. L. Jones	RBCM	[1]	0
Shawnigan Dist.	123 33 00	48 39 00		1952	4	13	J. R. L. Jones	RBCM	1	0
Tod Inlet	123 28 00	48 34 00		1928	5	6	W. H. A. Preece	CNC	0	1
Tod Inlet	123 28 00	48 34 00		1928	5	13	W. H. A. Preece	CNC	0	2
Trial Is.	123 18 19	48 23 57		1952	5	2	G. A. Hardy	RBCM	1	0
Trial Is.	123 18 19	48 23 57		1953	5	25	G. A. Hardy	RBCM	1	0
Vancouver Is							H. Edward	AMNH	0	1
Victoria	123 22 43	48 25 50		1887	5	22	J.M[acoun].	CNC	0	2
Victoria	123 22 43	48 25 50		1902	5	9	And[erson]	CAS	1	1
Victoria	123 22 43	48 25 50		1903	5		E. M. Anderson	CNC	1	1
Victoria	123 22 43	48 25 50		1903	5	3		RBCM	0	2
Victoria	123 22 43	48 25 50		1908	4	20	Gunder Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50		1909	5	6	And[erson]	CAS	1	1
Victoria	123 22 43	48 25 50		1909	5	16	A. J. Croker	CAS	1	0
Victoria	123 22 43	48 25 50		1909	5	23	A. J. Croker	CAS	1	1
Victoria	123 22 43	48 25 50		1909	6	2	G. W. Taylor	JHS	1	0
Victoria	123 22 43	48 25 50		1910	4	30	A. J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1910	4	30		AMNH	0	1
Victoria	123 22 43	48 25 50		1910	5	6	A. J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1910	5	28	A. J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1912	5	4	E. H. Blackmore	RBCM	[2]	0
Victoria	123 22 43	48 25 50		1916	5	9	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1917	5	17		CNC	1	0
Victoria	123 22 43	48 25 50		1917	5	18		CNC	1	0
Victoria	123 22 43	48 25 50		1919	4	21		CNC	0	1
Victoria	123 22 43	48 25 50		1919	5	6	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1921	5	1	W. R. C[arter].	RBCM	[1]	0
Victoria	123 22 43	48 25 50		1922	4	18	E. H. Blackmore	AMNH	0	1
Victoria	123 22 43	48 25 50		1922	5	12	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1924	5	3	W. Downes	CNC	5	0
Victoria	123 22 43	48 25 50		1924	5	26	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1926	4	27	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1927	5	20	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1927	6	22	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1929	5	7	Gunder Coll.	AMNH	9	6
Victoria	123 22 43	48 25 50		1929	5	7	Preece	AMNH	0	1
Victoria	123 22 43	48 25 50		1929	5	7	Stremitzky Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50		1929	5	10	Preece	AMNH	0	1
Victoria	123 22 43	48 25 50		1929	5	11	Preece	AMNH	1	4

Appendix 6 (Continued).

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Victoria	123 22 43	48 25 50		1929	5	13	Preece	AMNH	0	1
Victoria	123 22 43	48 25 50		1952	5	1	ex. N. W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	2	ex. N. W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	3	ex. N. W. Gillman	YPMN	2	0
Victoria	123 22 43	48 25 50		1952	5	5	ex. N. W. Gillman	YPMN	4	0
Victoria	123 22 43	48 25 50		1952	5	6	ex. N. W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	7	ex. N. W. Gillman	YPMN	7	0
Victoria	123 22 43	48 25 50		1952	5	8	ex. N. W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	10	ex. N. W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1959	5	9	Richard Guppy	AMNH	0	1
Victoria	123 22 43	48 25 50		1959	5	9	Richard Guppy	AMNH	1	0
Victoria	123 22 43	48 25 50			4	23	Hulst Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50			4	24	Buchholz Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50			5	1	Buchholz Coll.	AMNH	1	3
Victoria	123 22 43	48 25 50			5	9	Hulst Coll.	AMNH	1	0
Victoria Dist.	123 22 43	48 25 50		1933	5	15	J. R. L. Jones	RBCM	[1]	0

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